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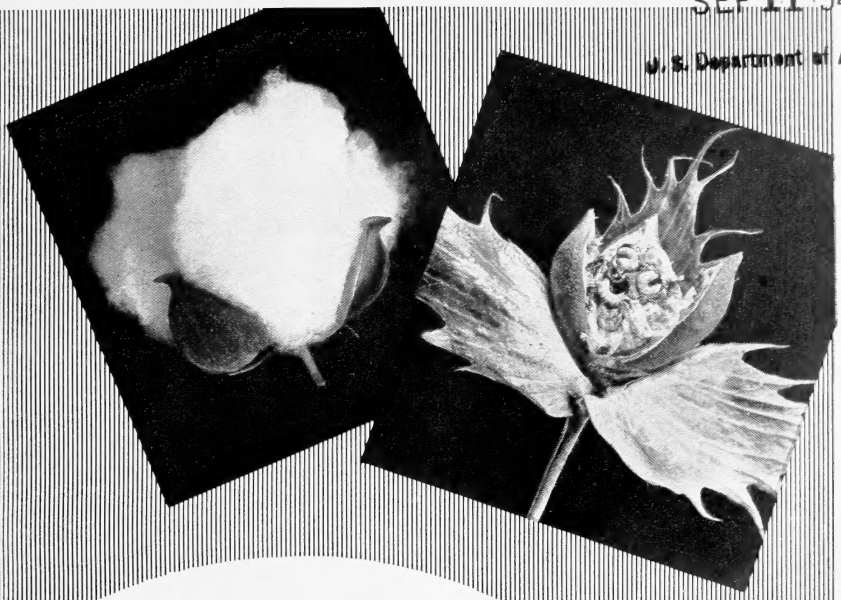

COTTON OR BOLL WEEVILS

U.S. DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION No. 484

THE BOLL WEEVIL is the most destructive pest of the cotton crop. So rapid has been its spread since it first invaded a few counties in southern Texas about 1892 that practically 90 percent of the entire Cotton Belt is now infested. This infested area produces about 90 percent of the cotton crop of the United States. The losses suffered by cotton farmers during years of heavy infestation by the boll weevil amount to many millions of dollars. The damage on individual farms varies widely. In some years injury is only slight; in others the cotton crop is seriously reduced. How to control weevil damage effectively has been a problem of much concern to the cotton States and to the Federal Government for many years.

This publication tells the important facts about the weevil—what it looks like, how it lives, how it grows, the damage it does, and the different ways of controlling it commonly used. Written in simple language, it is intended especially for boys and girls, although it should be useful also to grown-ups who want to learn about the weevil and how to fight it. Teachers, club leaders, and extension workers also should find this publication of value in teaching the necessary facts about boll weevil control.

COTTON OR BOLL WEEVILS [1]

By J. L. WEBB, *associate entomologist, Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine*

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INTRODUCTION

Insects, like all other living creatures, need food. But their eating is often of considerable importance to man because they injure or destroy crops upon which he depends for food, clothing, or other necessities.

Consider the boll weevil. To keep alive it must have green plant food. There are only two or three plants that it will eat, and cotton is one of them—in fact, the one it much prefers. When the weevil cannot get cotton, however, it will feed on other plants, such as okra and hollyhocks, which are close relatives of cotton.

The fact that this weevil feeds almost entirely on cotton is very important. When an insect eats only one kind of plant, it must have a great deal more of that plant each day for its food than it would need if it ate several kinds. Insects increase very fast and eat so much of their food plant that there is sometimes not enough left for man to use. This is true of the boll weevil. Each year there are millions of these weevils and they get hungry every day. If there is no way to destroy them in the cotton fields, they will eat so much of the crop that there will not be enough left to pay the planters for growing it.

WHAT THE BOLL WEEVIL LOOKS LIKE

The boll weevil is a small grayish or brownish, hard-shelled beetle with six legs and a long nose, or snout (fig. 1). Persons living in the South have probably seen these insects in the cotton fields and may have picked them off the growing plants. Upon close examination a great many interesting things are to be found out about them.

In the first place, the weevil is only about one-fourth of an inch long and one-twelfth of an inch broad. Really it is very small to cause so much trouble. If a person looks carefully at one of them

[1] This publication supersedes Miscellaneous Publication 35, Cotton or Weevils, by J. L. Webb, formerly of the Division of Cotton Insect Investigations, Bureau of Entomology and Plant Quarantine, and F. A. Merrill, Extension Service. Mr. Webb died January 20, 1942.

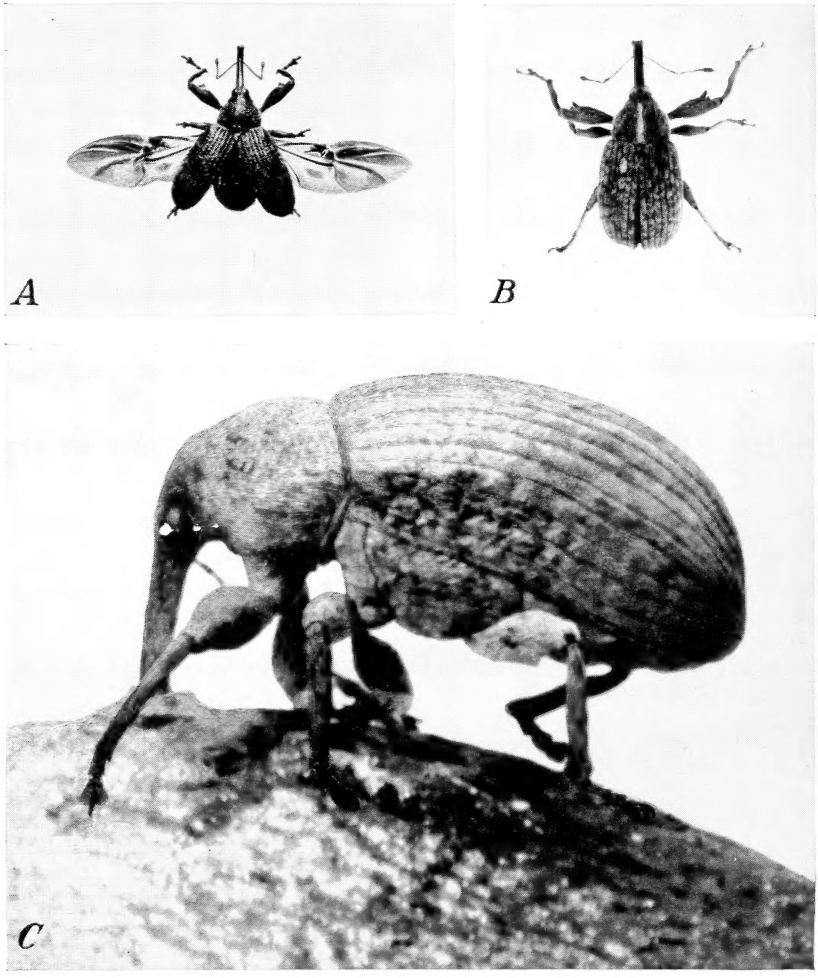

FIGURE 1.—The adult boll weevil can either walk or fly, as it chooses. A weevil with wings spread, as in flight, is shown at *A*. *B* shows a weevil with legs spread out, as seen from above, and *C* a weevil feeding on a cotton boll, as seen from the side. *A* and *B* are about 4 times natural size, and *C* is about 20 times natural size.

through a magnifying glass, he will see that the weevil's mouth is at the end of its snout and that it has a double pair of jaws for biting and chewing. And this little weevil can either walk or fly, just as it chooses.

HOW THE BOLL WEEVIL GROWS

The parts of the cotton plant that boll weevils like best as food are the flower buds, or squares, as the planter calls them. But before the squares come in the spring, the weevils will eat the tender leaves on the growing tips of the plant. The female weevil also uses the squares as a place to lay her eggs. She first eats a tiny hole in the bud and

then puts a very small pearly-white egg in it. The egg is about the size of a pinhead and is pushed deep down in the hole. In a short time the juices of the plant harden around the egg and completely seal it up within the square. About 3 days later the egg hatches, and a tiny, white, footless grub appears. This grub looks very much like a small worm, and all it can do is eat and grow.

Owing to the care taken by the mother weevil in placing the egg within the square, the little grub finds itself actually touching the very kind of tender, juicy food that it needs. After eating away for 7 to 12 days, the grub, or larva, as the scientist calls it, becomes full grown (fig. 2, *A*) and changes into another stage, called the pupa (fig. 2, *B*). This stage in the life of the weevil is like the well-known chrysalis stage of the butterfly, when no food is needed.

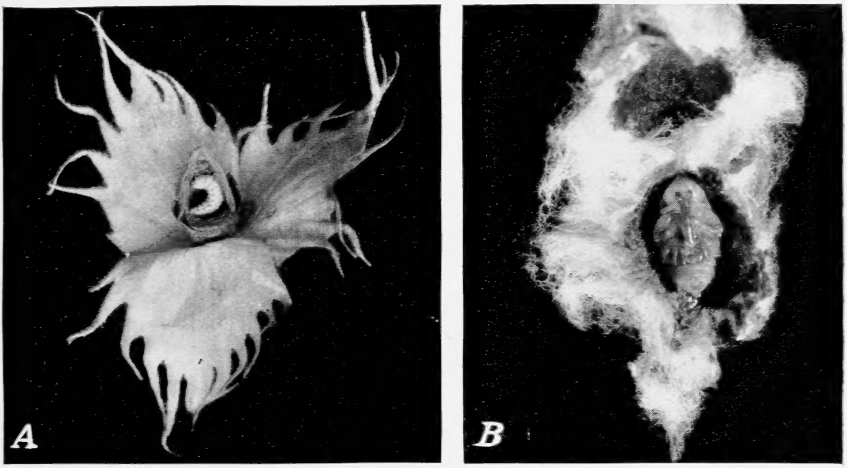

FIGURE 2.—The pearly-white egg which the mother weevil puts into a tiny hole in the cotton square hatches into a grub. This grub eats and grows for 7 to12 days. It then changes to a pupa. The weevil grub is shown at *A* and the pupa at *B*. *A* is about natural size and *B* about twice natural size.

After the pupal stage of the weevil has lasted from 3 to 5 days, another change takes place; the little creature sheds its skin and wriggles clear of it in the exact form of the parent weevil that laid the egg. The egg has now become an adult weevil, which is ready to leave its childhood home. It is still inside the walls of the square, but by using its tiny jaws it soon cuts a hole the size of its body and crawls through it to the outside world.

When the weevil first comes out of the cotton square, its body is soft and reddish-brown colored. After it has found food and lived in the open air for a few days, the shell of its body hardens and turns a darker shade, but it does not grow any larger. About 5 days after it has left the square, the weevil, if a female, begins to lay eggs. This is the beginning of another generation. It usually takes from 2 to 3 weeks, depending on the weather, for a generation to develop through the different stages of egg, larva, and pupa, to the adult. There are several generations each year, made up of males and females in about equal numbers.

HOW AND WHERE THE BOLL WEEVIL SPENDS THE WINTER

In the fall, when the weather turns chilly and the nights are frosty, the cotton plant stops fruiting and the boll weevils have no more food. They then look for a shelter of some kind and take a long winter nap, as a bear does. But they do not always have such a well-sheltered place as a bear's den in which to make their winter bed. Some of them will creep under dead grass or fallen leaves, whereas others will fly to the Spanish moss that hangs from tree branches in long gray streamers in some parts of the Cotton Belt. This moss (fig. 3) is a favorite sleeping place, although it would not seem to offer much protection in winter.

FIGURE 3.—In the fall, when the weather turns chilly and the nights are frosty, the boll weevils look for shelter of some kind in which to take their long winter nap. Favorable shelters adjoining cotton fields are weeds, grasses, woods trash, and Spanish moss hanging from the trees.

A great many weevils never wake from their sleep but are killed by the cold of winter. It has been found, by men who have kept the insects in large outdoor screen cages over winter, that in ordinary years only about six or seven out of a hundred ever wake up in the spring. When weevils are kept in cages like these for study, they are given the kind of sleeping quarters they would themselves choose, and the cages are kept in the same weather that the insects would have to stand if they were in their natural homes. If the weather is extremely cold during the winter, very few weevils will live; but if it is unusually warm, more will live.

Early in the spring the weevils begin to wake up, but they do not all wake up at the same time. Some are early risers whereas others are late sleepers. Some of them wake up in March while others appear in April and May, and some stragglers do not come to life even until June and July. If the newly awakened weevils find cotton

growing, they do not lose much time in taking a meal. But if it is too early for the cotton plants to be above the ground, they simply go without food until plants do appear. At this time of the year active boll weevils can live without food for several days.

HOW THE BOLL WEEVIL INJURES THE CROP

The female weevil likes the square much better than any other part of the plant for laying her eggs. The growing grubs require a lot of food, and by the time they have finished feeding all the inside of the square has been eaten. It will never bloom, for it is dead. Frequently these eaten squares drop off the plant and fall to the ground. Even before they drop they look very different from healthy squares. They become whitish, and the three outer leaves, or bracts, open out, or flare. In a healthy square these bracts are pressed together. The difference between a healthy square and a flared square is shown in figure 4.

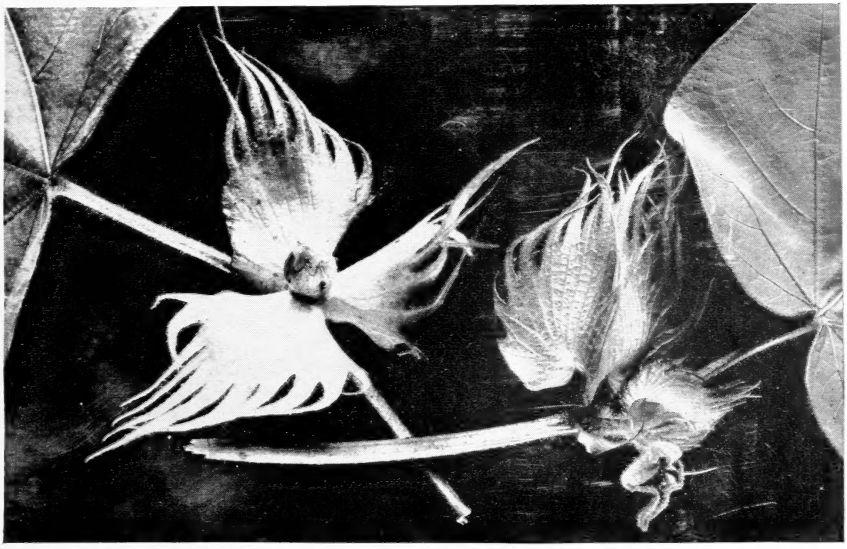

FIGURE 4.—Photograph shows how the three outside leaves, or bracts, flare out when the inside of the cotton square has been eaten away by the boll weevil grub. At the left is a flared square, which has been eaten out by the weevil grub. At the right are healthy squares. About two-thirds natural size.

Sometimes there are not enough squares for all the eggs, and then the female has to hunt some other place to put them. If it is late enough in the season for the plant to have bolls, she will lay her eggs in these. A boll is the fruit of the cotton plant and is what the square grows into. The boll is not a fruit such as man can eat. This word "fruit" is hard to understand sometimes because it is used in two ways. Some speak of fruit as that part of a plant which one can eat. A botanist—that is, a man who studies plants—calls the fruit that part of the plant which makes the seeds, regardless of whether it can be eaten. Many plants first form buds, which grow into flowers and then into fruit. Some plants, such as the ferns and mosses, do not make fruit in this way, but most of the common plants do.

After the squares on the cotton plant open into blossoms, the bright, showy parts soon fade and drop off. What is left after the flower drops is a small, rounded, green boll, which grows larger and larger as the weeks go by. Inside the boll are growing the seeds, which are covered with the white cotton fibers, or lint. If the boll is not injured by weevils, it will open later in the bright sunshine, and the pure white cotton will be seen peeping out ready to be picked. When the cotton is picked out, the dark cottonseeds come along with it and have to be separated from the cotton before it can be used to make cloth and clothing.

Early in the season the female weevils do not usually place more than one egg in each square, but late in the fall, when sometimes hardly a square or boll can be found without an egg in it, several eggs may be put in a single boll. Because the females do not like bolls so well as squares as places to lay their eggs, the early bolls usually are not harmed by the weevils if there are plenty of fresh squares to be had. But many of the late bolls often have weevil grubs in them. The grubs eat the soft seed and cause the lint to be short and stained brown. When several grubs feed in one boll, the lint is of poor grade or so badly damaged that it is unfit for picking.

Once a boll weevil egg is placed in a square, and the egg has hatched into a grub, that square is doomed to die. It will never open into a beautiful flower, to be followed by a boll of cotton, because the young grub will kill it. If, then, the weevils lay many eggs, the planter, when he goes to pick his cotton in the fall, will not find much to pick. His fields, which should have been white with cotton, will be dreary wastes, and he will not have money for food and clothing, which his cotton would have bought if it had not been destroyed. Men who have studied the matter carefully say that the boll weevil destroys about one-tenth of the crop produced in the United States each year, or over $2,000,000,000 worth of cotton.

WHERE THE BOLL WEEVIL CAME FROM AND WHERE IT IS NOW

Years ago the boll weevil was a stranger in this country. About 1892 the first weevils entered the United States from Mexico. They came into this country near Brownsville, Tex., and, judging from the damage they have done, they can certainly be considered "undesirable foreigners."

But the first comers were hardly noticed. Scientists in the United States Department of Agriculture who study and know most about good and bad insects—entomologists they are called—realized then that these weevils would become bad citizens, but none of the people of the South imagined that they would increase to enormous numbers and spread all over the Cotton Belt. By 1894 they had covered a half dozen counties in southern Texas. Even then, outside the counties where there were a good many weevils, the people were not much alarmed. Cotton growers living in other States and even in other parts of Texas were sure that this new "cotton bug" was not going to bother them.

As soon as the weevils were settled in their new home in Texas, they began to spread to new territory. Nothing seemed to stop them as they advanced across the Cotton Belt. In 1923, 29 years later, they had reached the farthest northern cotton fields in Virginia. The spread of this weevil for each 5-year period up to 1922 is shown in figure 5. During this time the weevils advanced from 40 to 160 miles each year.

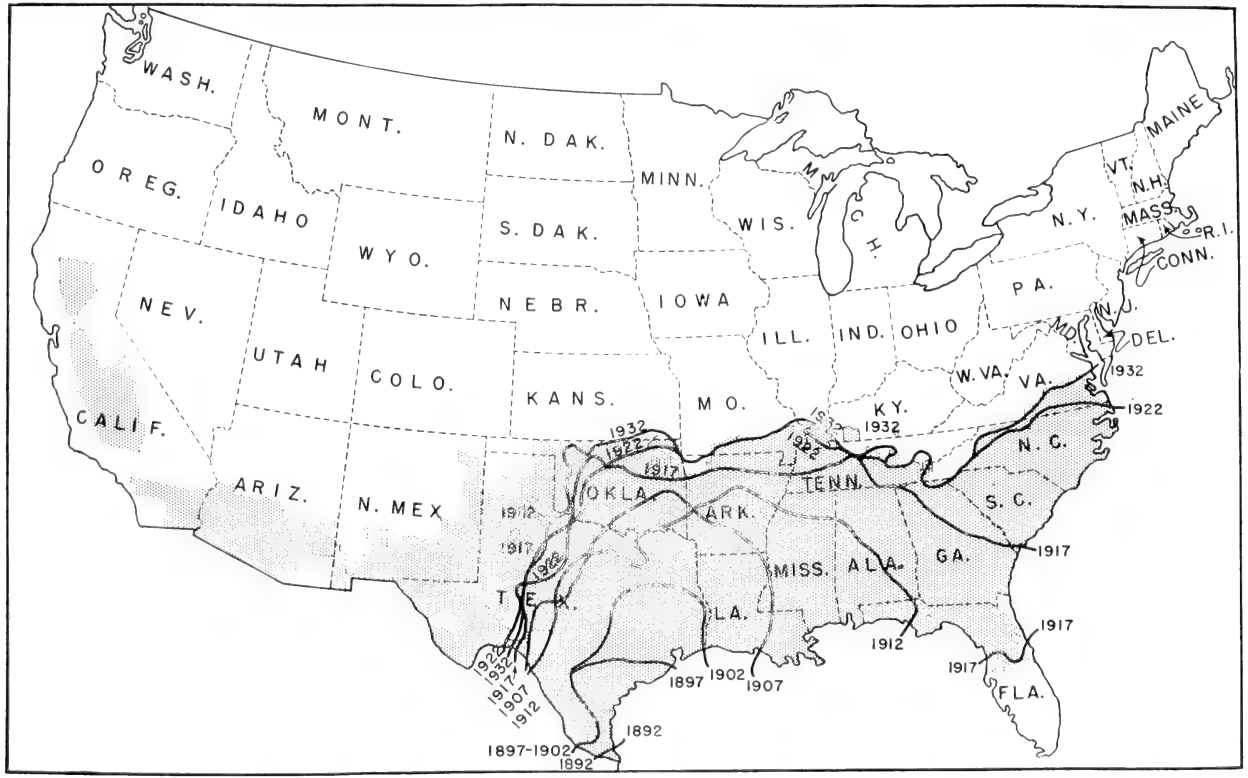

FIGURE 5.—From about 1892, when the first boll weevils entered the United States from Mexico, until 1922 the weevils advanced from 40 to 160 miles each year. Now they can be found in nine-tenths of the cotton-growing area. This map shows the spread by 5-year periods and the cotton-growing area of the United States.

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At a certain period in the summer, usually July or August, the weevils become restless and seem to want to leave the cotton fields where they have been living and go to other fields, where they can live more easily. As long as there are fields of cotton free from weevils anywhere nearby, the weevils are sure to fly in that direction.

The only thing that will stop the progress of the weevils across the country is a lack of fresh cotton fields or a very dry climate. Weevils do not breed fast when it is dry and hot and do very little damage at that time; they need a warm, moist climate. Thus in eastern Texas, where the summers are cool and moist, they infest all the cotton territory, but in western Texas they have done very little damage because there the summers are very hot and very dry. The boll weevil is to be found in nearly every part of the cotton-producing area except the Southwest. It is also found in Mexico, Central America, Cuba, and Haiti. The map in figure 5 shows where cotton is grown in the United States and where weevils are found.

HOW NATURE HELPS TO CONTROL THE BOLL WEEVIL

When one begins to study how to get rid of boll weevils, he finds that nature helps to destroy them. It has been estimated that the possible children, grandchildren, great-grandchildren, and great-great-grandchildren of a single pair of weevils born in one season could amount to several million weevils if nothing happened to them. But something does happen to a great many of them. If this something did not happen to them in a natural way, and if every one of them grew, it would be impossible for farmers to raise a bale of cotton no matter what they did to control these pests.

Some kinds of climate will kill off the weevils very fast. Often squares with the young weevils in them fall to the ground and become so heated by the direct rays of the sun that the little creatures inside die in a short time. Too much dry heat is bad for the young weevil, and this is the reason a cotton farmer likes a hot, dry summer; it gives his cotton a chance to grow.

There are certain insects whose young like to eat the soft weevil grubs. These tiny wasplike insects lay their eggs in the bodies of the boll weevil grubs. The eggs hatch into very small grubs, which feed on the boll weevils and kill them. Sometimes as many as half the young boll weevils in a cotton field are killed in this way, while in other fields very few or none seem to be killed.

Then there are other insects that cut their way into the infested squares and eat up the soft-bodied little weevils found there. The most important of the insects that eat the boll weevils are certain kinds of ants. These ants seek out the infested squares and gnaw through the wall to feast upon the juicy grub inside. Often a large number of the weevil grubs and pupae in a cotton field are destroyed in this way.

The most effective way, however, that nature helps man to control the boll weevil is by means of heat and cold. Very hot weather and very cold weather are even more distressing to a weevil than they are to man. A very cold winter, followed by a bright, hot summer will generally stop the weevils from increasing to numbers large enough to do serious damage to the cotton crop. On the other hand, if the winter is mild and the following summer is wet and cloudy, large numbers of weevils and much damage may be expected.

HOW TO FIGHT THE BOLL WEEVIL

There is no question but that the boll weevil does an immense amount of damage to cotton. How can cotton be protected from these pests? What is the best and easiest way to get rid of these weevils? Men have been trying for years to answer these questions. Some of these men have come to the conclusion that the boll weevil cannot be gotten rid of, but that it can be controlled sufficiently to permit good crops of cotton to be raised. This is a big help even if every weevil cannot be destroyed. It is best to learn what these men advise and to follow their directions.

Nature cannot be depended on to do all the controlling, because exactly what the weather will be during the cotton-growing season is never known. It is not at all certain that the summer will be hot and dry, and so man has tried hard to find something that would help him to protect the cotton. In all the years since the people of the Cotton Belt began to realize how much damage the boll weevil could do, they have tried to find some way of killing this pest. Every kind of machine or poison that could be thought of has been tried. Finally, in 1908 and 1909 agents of the Louisiana Crop Pest Commission tried lead arsenate in dust form with very promising results. However, no general use of this dust for boll weevil control followed.

In 1914 field agents of the Bureau of Entomology, of the United States Department of Agriculture, began experimenting with a white, powdery poison known as calcium arsenate, or arsenate of lime. This they dusted evenly on the cotton plants during the early morning while dew was still on the leaves and squares.

Now the weevil grubs that were feeding inside the squares or bolls could not be reached by the poisonous calcium arsenate. But the full-grown weevils crawling over the plant looking for places to feed and lay their eggs were poisoned in the following three ways: (1) While crawling around, the weevils continually touched the tips of their snouts to the plant. Because their tiny jaws were moist, the small particles of calcium arsenate stuck to them and were swallowed. (2) The weevils drank the dew that had been poisoned, and (3) they ate particles of calcium arsenate when they fed on the dusted plants.

The field agents were encouraged by these results and a few days later they dusted the plants again. They found that more weevils had died, and so they felt that they were on the right track in destroying the insects. They dusted the plants a third time and then found that there were many more blooms in the field than when dusting was started. This meant that the weevils were being killed off faster than they could damage the new blooms by laying eggs in the squares.

The agents felt then that they had at last found something which would protect the cotton from too great damage. They thought that if the weevils did not become too numerous later a good crop of cotton would be produced. The field was carefully watched throughout the summer, and, whenever weevils appeared to be getting thick again, another dusting of calcium arsenate was made. When fall came there was a good crop of cotton, while in a field across the road, which had not been dusted, there was hardly any cotton.

For several years after this first experiment Government workers tested this way of controlling the boll weevil to be sure that they were

right and to find out the best and least costly way of using the calcium arsenate dust. Cotton planters were afraid at first that the expense would be so great that it would not pay to dust their cotton. They know now, however, that it will pay if the weevils are seriously hurting the crop and if the land on which the cotton is growing is rich enough to produce one-third of a bale to the acre when there is no boll weevil damage. Planters have learned also that if the dust is put on the plants at the right time and in the right way a good crop will follow.

Poison dust cannot be put on the plants in the right way without proper dusting machines, which are specially built for this work. There are many kinds of these machines on the market, the hand dust gun being the smallest. As shown in figure 6, the man who uses the

FIGURE 6.—The hand dust gun is the smallest machine for dusting cotton plants with calcium arsenate to kill the boll weevil. The man who uses it turns a crank, which causes a fan to blow the dust out of the long nozzle sticking out of the front.

hand dust gun walks between the cotton rows and turns a crank on the machine, which causes a fan on the inside to blow the dust out of the long nozzle at the front. The man who operates the machine must keep the end of the nozzle pointed toward the cotton row while he turns the crank, so that the dust will be sure to fall on the plants. It is very hard work to operate one of these machines all day long. Hand dust guns cost from $12 to $20 each, and one gun can be used to dust 8 to 10 acres of cotton over the season.

The one-mule machine is pulled by a mule or horse, which walks between two rows of cotton. There are two nozzles sticking out behind this machine, as shown in figure 7, and the dust is blown through them onto two rows of cotton as the machine moves through the field. This machine costs from $75 to $125, and one machine will dust 15 to 20 acres in a single night and as much as 60 acres through the season.

The cart machine has two wheels, which straddle the cotton rows, and is drawn by two mules or horses. It has three or four nozzles and on one or both cart wheels a sprocket gear and a chain that drives the

FIGURE 7.—The one-mule dusting machine is pulled by a mule or horse, which walks between two rows of cotton. The dust is blown through two nozzles onto two rows of cotton as the machine moves through the field.

duster. One machine will dust 25 to 40 acres in a single night and about 100 acres through the season.

The larger dusting machines, which dust from 5 to 8 rows of cotton at a time, are called power-operated machines. One kind (fig. 8) is

FIGURE 8.—The cart dusting machine has two wheels, which straddle the cotton rows, and it is drawn by two horses or mules. It has five nozzles and is operated by a gasoline motor.

like the cart machine, but has a gasoline motor on the platform to furnish the power. Another kind of power duster is bolted on the rear of a tractor and is operated from the power take-off of the tractor. The power-operated dusting machines are best suited for large farms, with 100 to 300 acres of cotton.

Since about 1922 the airplane, too, has come to be used as a dusting machine (fig. 9). Of course this does not mean that any airplane can be used for this work. The low flying that is done in cotton dusting is more dangerous than that done high up in the air. The plane has to be flown so close to the ground that it almost touches the cotton plants, and it cannot be flown so fast as those high up in the air.

FIGURE 9.—Calcium arsenate dust being applied to a field of cotton by airplane.

Fortunately for this kind of work there are specially built planes that can stay in the air while going much more slowly than ordinary planes.

The dusting planes must also have special machinery for carrying and releasing the poison dust. There is a little door to the dust compartment that can be opened when the airplane pilot is ready for dusting work. This opening can be so regulated as to let out just the quantity of calcium arsenate needed and then closed when no more is necessary. When the door is opened, a stream of dust falls through and is violently driven backward and downward by the current of air from the airplane propeller. Gradually the dust cloud spreads outward to each side of the plane and drifts in very fine particles to all parts of the cotton plants (fig. 9). One airplane will dust as much cotton as 50 cart dusters.

Airplanes for cotton dusting are not owned by individual planters, as is the usual dusting machinery, for they are far too expensive for most farmers to own. Instead, they are owned by commercial companies that do the work for the planter at a definite price per acre.

It costs the planter about the same to have his fields dusted by airplane as it would for him to do the dusting himself with horse-drawn machines.

WHEN AND HOW TO USE CALCIUM ARSENATE

There are a few simple rules that should be observed when calcium arsenate dust is used against the boll weevil. They are easy to remember and should be learned and carefully followed if the cotton is to be saved from the weevil.

First, get a supply of the dust and such dusting machinery as will be needed. Do this long before it is time for the weevils to injure the cotton. If the dust is to be put on by airplane, make arrangements with one of the airplane-dusting companies in the spring before the dusting is to be done.

Next, look over the field soon after the plants have begun to put on squares. After the squares have appeared in the field, examine some of them every few days to see whether they have been punctured by weevils (fig. 4) or have weevil grubs inside them (fig. 2). If you find infested squares, examine 100 squares and count those that are punctured or have grubs in them. If 10 or more of the 100 squares are punctured, then it is time to begin dusting. Before beginning to dust, however, examine carefully all parts of the field, at least the 4 corners and the middle. Sometimes only a part of the field, usually the edge nearest the woods, will need to be dusted.

You may wonder why poisoning should be delayed until so many squares are infested. It is because the cotton plant has the habit of putting on more squares than will ever open into blooms. A great many of these squares drop off without being injured at all. So it is easy to see that up to a certain point the squares which fall on account of boll weevil injury are merely taking the place of the squares which would fall anyway.

Remember that dusting should be done when the air is calm and the cotton plants are moist with dew. The dust sticks to the plants better and less will be wasted if they are moist and no breeze is blowing. It is important to dust all parts of the plants thoroughly so that the weevils will get some poison wherever they feed or crawl. Therefore, if hand- or power-operated machines are used, the dusting will have to be done in the late afternoon, at night, or early in the morning. Airplane dusting is usually done early in the morning.

Calcium arsenate is a poison and must be handled very carefully. After you use it, wash the hands well before handling food. Most States now require calcium arsenate to be colored so that it will not be mistaken for flour or livestock feed.

Dust 5 to 6 pounds of the poison on each acre of cotton at a time. Dust the plants again at the end of 4 or 5 days. Usually 3 or 4 dustings will be sufficient to bring the weevil under control. If later in the season the insects should get numerous enough to injure the cotton bolls, dust the field once or twice more. If it rains within 24 hours after dusting, redust the plants as soon as the rain stops.

Some growers in the South Atlantic Coast States do not wait until the squares are large enough to be punctured by the weevils before they begin poisoning. Weevils, if present before the squares form, feed on the tender leaves in the top of the plants. At this time

calcium arsenate may be used as a dust or as a liquid. If dust is used only 3 to 4 pounds to an acre are needed. The liquid poison most often used is a mixture of 1 pound of calcium arsenate, 1 gallon of molasses, and 1 gallon of water. This sweetened poison is smeared on the top of the plants with a mop made by tying a rag around the end of a stick. The mop is dipped in a bucket of the poison and is pushed through the top of the plants as the worker walks along. A little of the mixture is thus smeared on the leaves and stems. Mopping should be done during the day when the plants are dry, so that the weevils will drink the sweetened poison.

Many growers often waste money by putting poison on the plants early when there are no weevils. But when there are very many weevils, dusting or mopping should begin when the first squares are just large enough to be seen. If there are still a lot of weevils, another dusting or mopping should be made in 5 to 7 days. After two or three of these treatments the squares are usually big enough for the weevils to puncture and then mopping is no longer of any use. Mopping costs a little less than dusting, it can be done at any time of the day, and it requires no dusting machines.

The use of poison before the squares form helps to cut down the number of weevils early in the season, but the plants will usually have to be dusted with calcium arsenate after the squares form if the weather has been favorable for the weevils. Even though early treatments are used, growers should not depend on these alone to control the weevils. The cotton should be examined often, and if 10 percent or more of the squares are infested before a full crop of bolls have set, the plants should be dusted.

OTHER WAYS OF DESTROYING THE BOLL WEEVIL

The farmer may fight the boll weevil in many other ways besides using calcium arsenate. Sometimes it will not be necessary to go to the expense of poisoning if other methods are used. One of the most important is to cut down the cotton plants early in the fall. At that time there are likely to be many young weevils in the squares and bolls that are still on the plants. If they are left in the fields, the weevils will grow into adults and then go into their winter sleep. Those that live through the winter will attack the young cotton plants the next spring. To prevent this, all the cotton plants should be cut down or completely plowed up as soon as possible after the crop has been picked. If the cotton stalks are destroyed early in the fall, the food of the adult weevils will be taken away and they will go into their winter sleep hungry. Weevils weakened by hunger are less likely to live through the winter. To kill many weevils, the stalks should be destroyed before the first killing frost.

If the fields cannot be cleaned up before frost time, it is often a good thing to pasture them with livestock, letting the animals eat as much of the plants as they will. Even if poison has been used earlier in the season, not enough of it will stay on the plants after two or three rains to hurt the grazing animals.

Since the weevils use any kind of grass or weeds for winter shelter, it would be well to clean up around the edges of the cotton fields, along fence rows, and in all the ditches on the farm. If this is done thoroughly, many of the weevils will be killed by the cold.

Two very important points for farmers to bear in mind when growing cotton in parts of the country where there are boll weevils are (1) to select cotton seed of a kind that will grow and produce ripe cotton as quickly as possible and (2) to plant this seed as early in the spring as possible after all danger from frost is past. If a kind of cotton that will grow and ripen quickly is used, and if it is planted early enough in the spring, there will be a chance for the crop, or at least a part of it, to ripen before the boll weevils become numerous enough to do serious damage. In other words, it is a race between the cotton plants and the weevils, and, as in all races, the runner who gets off first has a great advantage.

There are other ways of producing a good crop of early cotton. The land should be plowed early and thoroughly prepared for the seed bed, so that there will be no delay in early planting. The proper use of the right fertilizers will give larger yields and help the crop to ripen faster.

Careful cultivation during the growing season is necessary, too, if a good crop is to grow. The plow should not be run too deep or too close to the plant, for this will cut off some of the roots and make the squares drop off. If there are plenty of bolls, there is a fair assurance of a good crop of cotton (fig. 10).

FIGURE 10.—Field containing a good crop of cotton. It had been properly dusted with calcium arsenate to kill the boll weevils.

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